

Hilltopping behavior by males of *Tachysphex menkei* Pulawski (Hymenoptera, Crabronidae)

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Abstract

Males of the little known crabronid wasp *Tachysphex menkei* Pulawski engage in hilltopping behavior at the peak of Usery Mountain in central Arizona. Males are active at midday in the late spring at this location. Individuals perch on and launch out and back flights from small rocks near prominent plants growing at the highest parts of the undulating ridgeline that makes up the peak. The same set of sites attracted two generations of males (in 2009 and 2010). If site-faithful males are territorial (and if size influences territorial success), resident males (those that returned to their perches over at least two days) should be larger on average than the males that replace them after the residents have been removed. This expectation was met. In keeping with the hypothesis that hilltopping is a mating system of last resort, only a few males were seen on any given day and no females were observed, suggesting that the population of the species is small and dispersed, at least in central Arizona.

Keywords

Mating system, Arizona

Introduction

Many butterflies, flies and ants employ hilltopping mating systems in which males fly to conspicuous landmarks to await the arrival of receptive females (Skevington 2008). However, only a few wasps have been reported to use this method of mate location (Alcock 1981, Alcock 2007a, Alcock 2007b, Dodson and Yeates 1989). The

apparent scarcity of hilltopping wasps applies strongly to the Crabronidae, which includes the species that were once placed in the Sphecidae. However, hilltopping by a number of crabronids has now been described from a hilltop in central Arizona where males of several species of *Tachytes* and *Astata* engage in defense of scattered perching locations where they appear to be waiting for potential mates (Alcock 2007a, Alcock 2007b).

In this report, I provide an account of the hilltopping behavior of a small and inconspicuous crabronid, *Tachysphex menkei* Pulawski, a little known species from southern California and Arizona (Pulawski 2010). Although the nesting behavior of female *Tachysphex* has been the subject of a number of papers (e.g., Kurczewski 2010), relatively little has been published on the behavior of males of this genus (Kurczewski 1966, Kurczewski and Kurczewski 1987). *Tachysphex menkei* is the first representative of the genus known to exhibit the hilltopping mating system. I will document that its behavior is very similar to that of another crabronid whose males also occur on the same peak during the late spring and summer.

Methods

The study was conducted on 7 days in May 2009 and on 20 days from late April to early June 2010 at Usery Peak, near Mesa, AZ. The site lies within the Upland Sonoran Desert and attracts many hilltopping insects (Alcock 1987, Alcock and Carey 1988). A transect of about 300 m was established along the ridge that forms the top of Usery Mountain. The prominent paloverdes (*Parkinsonia microphylla* Torr.) and creosotebushes (*Larrea tridentata* (DC.) Coville) growing on the ridgetop were numbered, enabling an observer to identify the location of hilltopping insects in relation to these plants. When a male *T. menkei* was found, a record was made of its location and the time of day it was seen. If the individual was selected for marking, it was captured in an insect net, dotted on the thorax with paints from one or two fine point DecoColor paint pens, and then released. Thereafter, when marked males were seen their identity was recorded along with data on their location along the transect.

On May 19, 2009 and on May 16 and May 20, 2010, a total of 6 marked males known to have returned to a particular perching location over a period of at least two days (i.e., “resident” males) were captured and placed in vials within a chilled cooler. The site was then monitored for up to 70 min. If a replacement male arrived and perched on the vacant rock, it too was captured and placed in the cooler. Subsequently, all males taken in this fashion were transported to a home freezer. On a following day, the “residents” and “replacements” were weighed on a Mettler Balance accurate to 0.1 mg. The data collected in this manner were used to test the prediction that resident territory holders should be larger (heavier) than males that had yet to acquire a territory of their own.

Results

In May of both years of the study, males of *T. menkei* were consistently found perched on certain small rocks (Fig. 1) on Usery Peak. From their perches, males launched frequent flights out and back over a distance of no more than 50 cm. Four males watched between May 13 and May 16, 2009 engaged in 10 to 17 such flights per 2 min. Males appeared as early as 1012 and stayed as late as 1525, although the wasps were most often observed between 1100 and 1300. Many individuals were present over periods of 60 min or more, with one male recorded at a site for 2.25 hr.

The small rocks used by males as perch sites (Fig. 1) were found at a total of nine spots scattered along the 300 m ridgeline transect. Although it was common for some of these perch sites to be left unoccupied on any given day, two sites were nearly always taken with a male present on 19 of 20 days of observation at each location in the late spring of 2010.

At one place, two males sometimes perched on rocks separated by only 2 m but the next closest pair of nearest neighboring perch sites was 8 m apart. Each occupied site was near a prominent plant growing on a higher than average point along the ridge.



Figure 1. A male of *Tachysphex menkei* perched on a rock on Usery Peak that attracted a series of territory holders in the spring in two consecutive years (2009 and 2010).

In 2009, a total of six sites were used by perching males over the course of the study; in 2010, the same six sites plus three others were taken on occasion by perching males.

On some days at some sites, more than one male was recorded during the observation period, almost always because a male seen on one census was absent on a subsequent one and in his place was a different individual. In 2009, 21 records of this sort were accumulated with another 31 records gathered in 2010. Thus, the number of male wasps visiting the peaktop on a given day was often greater than the number of occupied perches on that day.

Males did not often interact with other individuals. In 2009, just two chases were seen in which a resident pursued a departing intruder. In 2010, six chases were recorded and one case in which two males grappled together on the ground after one male briefly captured a visitor to his perching area.

Males of *T. menkei* tended to be site faithful. In 2009, 27 males were marked and released; 14 returned on the same or subsequent day up to 7 days after marking. In 2010, 24 males were marked and released; 12 returned on same or subsequent day up to 4 days after marking, all but one to the site where they had been originally marked.

If it is true that at least some males were territorial as suggested both by their site fidelity and by occasional observations of chases between conspecifics, then we can predict that removal of an established resident would lead to his replacement by a smaller male, given that large body size is generally believed to confer an advantage in aggressive competition between male insects and other animals (Blanckenhorn 2000). There is considerable size variation among males of *T. menkei* with recorded weights ranging from 8.7 mg to 24.9 mg. The removal experiments revealed that five of the six resident males were in fact larger than all eight of the replacement males. The mean weight of the residents (21.4 mg) was also significantly greater than the mean weight (14.7 mg) of the replacements ($t = 3.85$; $df = 12$; $p = 0.002$).

Discussion

Although the genus *Tachysphex* contains hundreds of species (Pulawski 2010), only a handful have been studied with respect to mating system. Among those whose male behavior has been described are several species in which males perch on the ground in areas where a considerable number of females nest, thereby supplying the next generation of males and virgin females. This pattern applies to *T. albocinctus* (Lucas), a European species in which females typically nest in groups of several dozen individuals (Asis et al. 1989). The same relationship between male perch location and female aggregation is true for three North American species, including *T. terminatus* (F. Smith). In this species, Kurczewski (1966) documented that mating takes place within emergence areas where males have their perches, which they defend by pursuing intruders and occasionally grappling with them.

In species in which nesting and emerging females are probably dispersed, males either perch by themselves (Kurczewski 1966) or else they travel to a nectar source, as

shown for males of *T. antennatus* W. Fox, which pursue females at flowers (Kurczewski and Kurczewski 1987).

Tachysphex menkei is apparently the first known hilltopping member of the genus with larger males more likely to control lookout perches. The behavior of males of this species is very similar to that of another summer-active species of hilltopping crabronid on Usery Peak, *Astata boharti* F. Parker (Alcock 2007b). Site-faithful males of the two species both defend small landmark territories during the middle of the day at locations near prominent plants growing on the highest parts of the peak. Yet no female of either species has been observed visiting waiting males. This result is almost certainly related to the general rarity of these wasps coupled with the likelihood that their females are monogamous and mate quickly, as is probably true for most crabronids (Ayasse et al. 2001). Many observers have noted that hilltopping insects are often rare or widely dispersed, suggesting that hilltopping is a mating system of last resort for males unable to find receptive females as they emerge or while they forage for nectar or prey (Skevington 2008, Thornhill and Alcock 1983). The crabronid wasp *T. menkei* provides another example in support of this hypothesis.

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